


■ ■ ■ **First, what's the difference between climate and weather?**

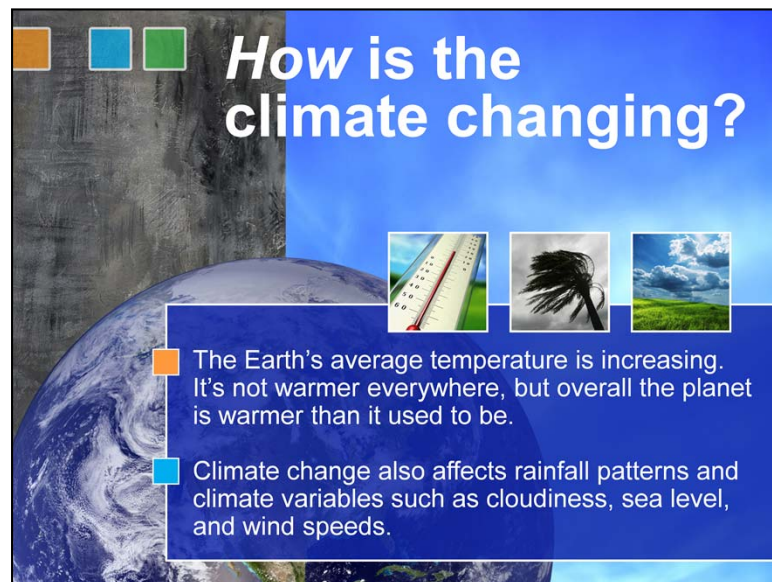
■ Weather is what happens outdoors every day. We describe weather in terms of temperature ("it's cold outside"), precipitation ("it's raining"), wind, humidity, cloudiness, air pressure, and other factors.



A woman with long dark hair, wearing a black tank top and blue jeans, stands on a globe of the Earth. She has her arms outstretched. The background is a bright blue sky with some white clouds. In the top left corner, there are three small squares: orange, blue, and green.

What is climate?

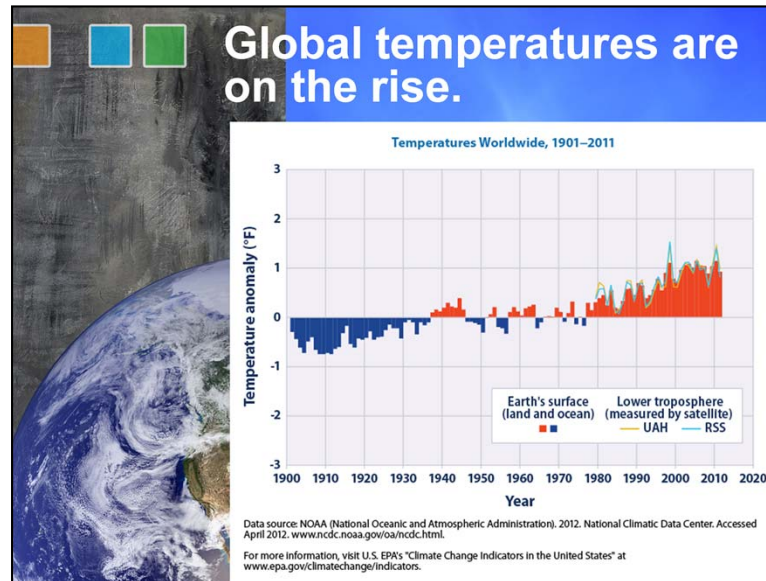
- Climate is the average weather over a longer period, ranging from months to thousands of years.
- When the climate changes, the average weather changes. For example, summers may become hotter, and winters may become wetter (more rain and sleet, less snow).



How is the climate changing?

- The Earth's average temperature is increasing. It's not warmer everywhere, but overall the planet is warmer than it used to be.
- Climate change also affects rainfall patterns and climate variables such as cloudiness, sea level, and wind speeds.

See EPA's "Climate Change Indicators" page at <http://www.epa.gov/climatechange/science/indicators/> for details on these changes.



The world has warmed by 1 to 1.7 degrees Fahrenheit over the past 100 years. That may not sound like much, but remember it's a global average. Some parts of the world have warmed more than the average, others less.

The United Nations Intergovernmental Panel on Climate Change has concluded that human activities very likely caused most of the warming over the past 50 years.

Source: <http://www.epa.gov/climatechange/science/causes.html>



Why is the climate changing?

- Some climate change is normal and natural. The climate has changed many times in Earth's history (for example, think of the ice ages).
- However, scientists believe that most of the recent changes in climate have been caused by people.

Climate change is caused naturally by factors such as long-term changes in the Earth's orbit, changes in the Sun's intensity, major volcanic eruptions, and changes in ocean currents.

But none of these factors can explain all of the warming that has occurred over the past 50 years or so.

You'll find a lot of good information on the causes of climate change on EPA's climate change science pages:
www.epa.gov/climatechange/science/

How could people change the climate?

- Burning fossil fuels (such as gasoline, oil, coal, and natural gas) for energy adds carbon dioxide (CO_2) to the atmosphere.
- CO_2 is known as a “greenhouse gas” because it contributes to the natural greenhouse effect that warms the planet.

Carbon dioxide is emitted by many natural sources (including humans and other animals, when we exhale). Normally these natural sources are balanced by natural “sinks” that remove carbon dioxide from the atmosphere, such as trees and the oceans.

Fossil fuels are made from plant materials that have been buried underground for millions of years. Those plant materials contain carbon, and when we burn them the carbon combines with oxygen to form carbon dioxide. Worldwide, humans are burning fossil fuels in such large quantities that the natural sinks can’t remove it quickly enough. So the carbon dioxide builds up in the atmosphere, warming the planet.

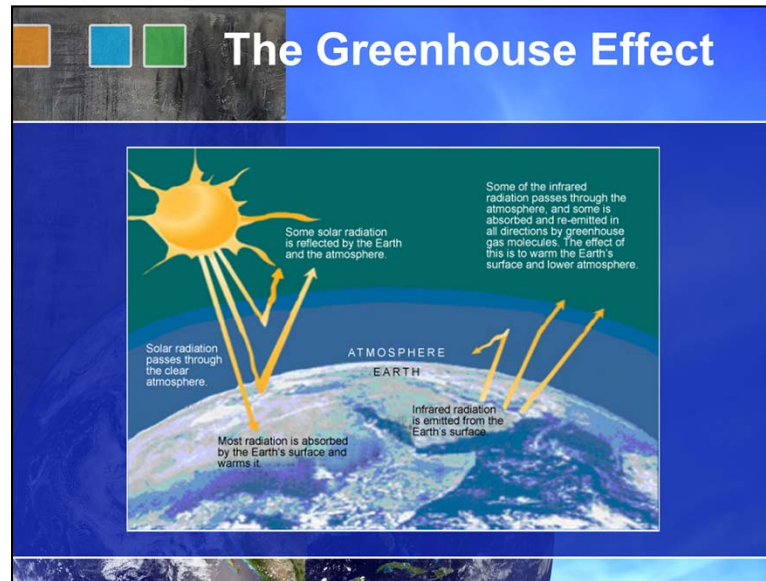
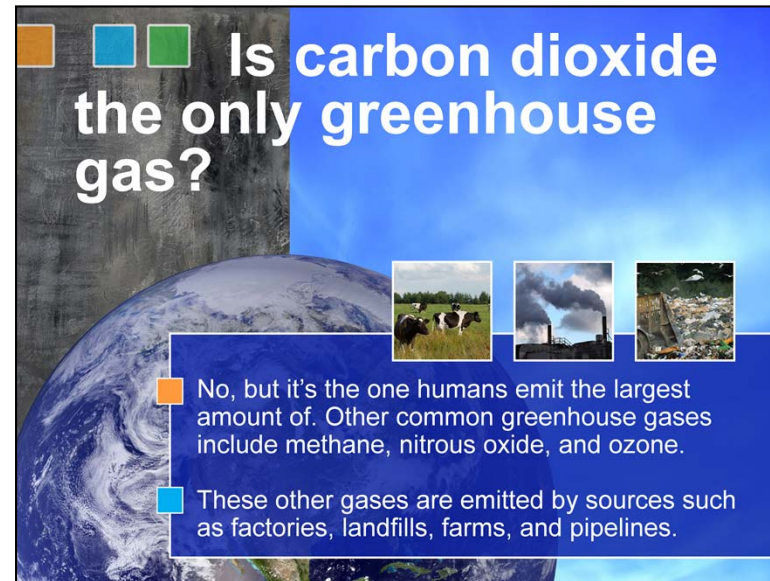



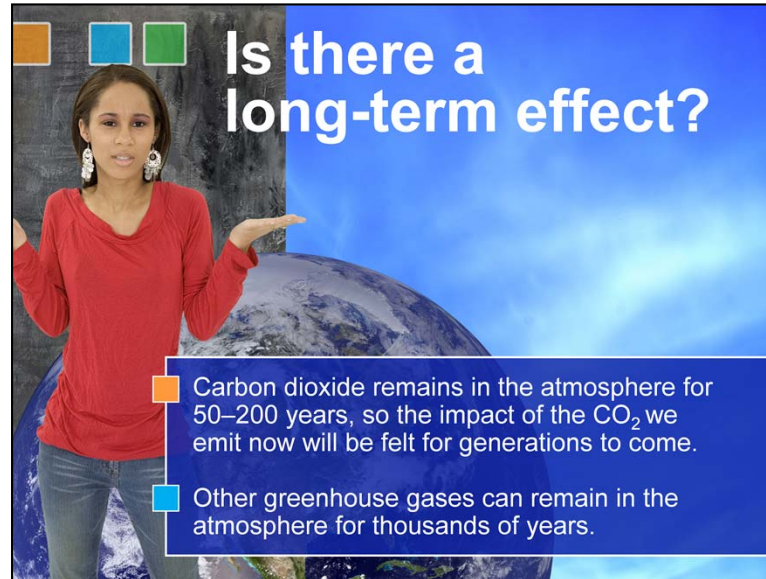
Image credit: White House OSTP publication from October 1997, entitled Climate Change: State of Knowledge. They credit the image as being created by M. Warford, 1995.



Is carbon dioxide the only greenhouse gas?




- No, but it's the one humans emit the largest amount of. Other common greenhouse gases include methane, nitrous oxide, and ozone.
- These other gases are emitted by sources such as factories, landfills, farms, and pipelines.



Is there a long-term effect?

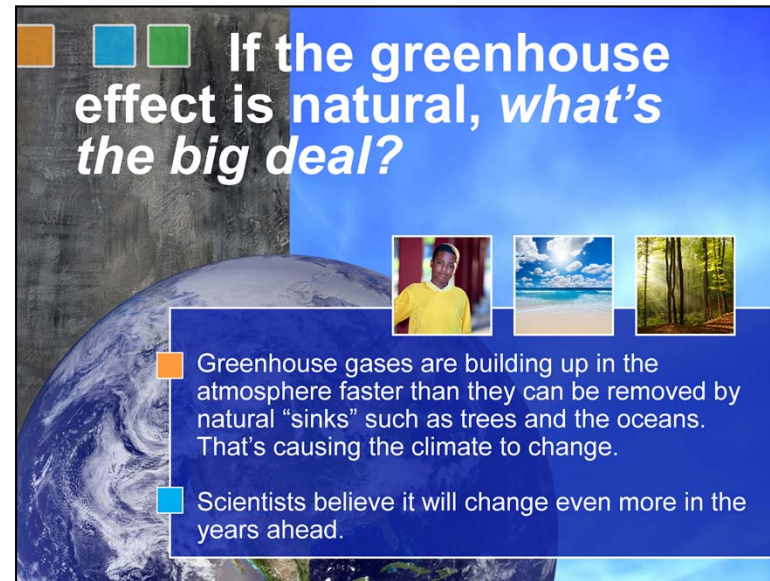
- Carbon dioxide remains in the atmosphere for 50–200 years, so the impact of the CO₂ we emit now will be felt for generations to come.
- Other greenhouse gases can remain in the atmosphere for thousands of years.



Isn't the greenhouse effect natural?

- Yes, most greenhouse gases occur naturally and include water vapor, carbon dioxide, and methane.
- The greenhouse effect has always existed. In fact, the planet would be 60° Fahrenheit colder than it is today without the natural greenhouse effect.

http://earthguide.ucsd.edu/virtualmuseum/climatechange1/02_1.shtml



If the greenhouse effect is natural, *what's the big deal?*

- Greenhouse gases are building up in the atmosphere faster than they can be removed by natural “sinks” such as trees and the oceans. That’s causing the climate to change.
- Scientists believe it will change even more in the years ahead.

It's the *increase* in the greenhouse effect that worries scientists.



How do we know the climate is changing?

- Years of weather station data from all over the world show that the climate is changing.
- Scientists also use indirect measures of temperature and precipitation (such as tree rings and pollen samples) to reveal changes in climate that occurred before people started keeping records.

Useful resources for more information:

EPA's web page on the causes of climate change: <http://www.epa.gov/climatechange/science/causes.html>.

EPA's Climate Change Indicators in the United States:
<http://www.epa.gov/climatechange/science/indicators/index.html>



How do we know that greenhouse gases are increasing?

- Collected air samples show that greenhouse gas concentrations are increasing in the atmosphere.
- Ancient air bubbles trapped in glacial ice show that CO₂ concentrations are higher now than at any time in the last 650,000 years.

Scientists collect air samples using weather balloons, towers, observatories, ships, and aircraft.
Useful resources for more information:

EPA's Web page on recent changes in concentrations of greenhouse gases:
<http://www.epa.gov/climatechange/science/indicators/ghg/ghg-concentrations.html>.



Image Credit: Muir Glacier, photographed by William O. Field on 13 August 1941 (left) and by Bruce F. Molnia on 31 August 2004 (right). NSIDC/WDC for Glaciology, Boulder, compiler. 2002, updated 2006. *Glacier Photograph Collection*. Boulder, CO: National Snow and Ice Data Center/World Data Center for Glaciology. Digital media. www.nsidc.org/gallery/glaciers/index.html.

A woman with dark hair, wearing a green patterned sweater and dark pants, stands on a globe of the Earth. The background is a bright blue sky with soft white clouds. In the top left corner, there are three small colored squares: orange, light blue, and green. The title 'What will happen in the future?' is written in white text on a blue background in the top right. Two text boxes with colored square icons are positioned in the lower right area of the image.

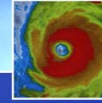
What will happen in the future?

- Nobody can predict the future with certainty. But most scientists agree that the climate will keep changing.
- During this century, the Earth is expected to warm by another 3 to 7 degrees Fahrenheit.

Check out EPA's "future climate change" page for more details:

<http://www.epa.gov/climatechange/science/future.html>

Why should we care if the climate changes?



- Changes in temperature, precipitation, sea level, and weather patterns could have important effects on plants, animals, and people.
- Some of those effects could be welcome, such as longer growing seasons in the North, but others may be harmful, such as heat waves and poor air quality.

Some of the potential effects of climate change:



- Warmer temperatures may cause some plant and animal species to shift their ranges northward.
- Droughts and floods may become more frequent in some areas.
- Higher sea levels may increase coastal flooding and erosion.
- Agriculture may benefit in some areas but suffer in others.

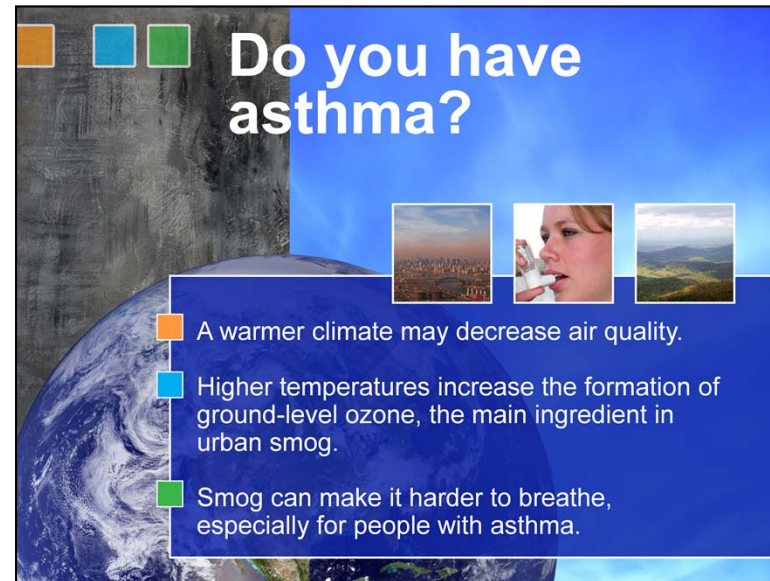


A global problem with local effects


- Climate change is happening worldwide, but its effects are felt differently from place to place.
- In general, wet areas will become wetter and dry areas will become drier.

Some areas will see big changes in weather and climate, while others experience little change.

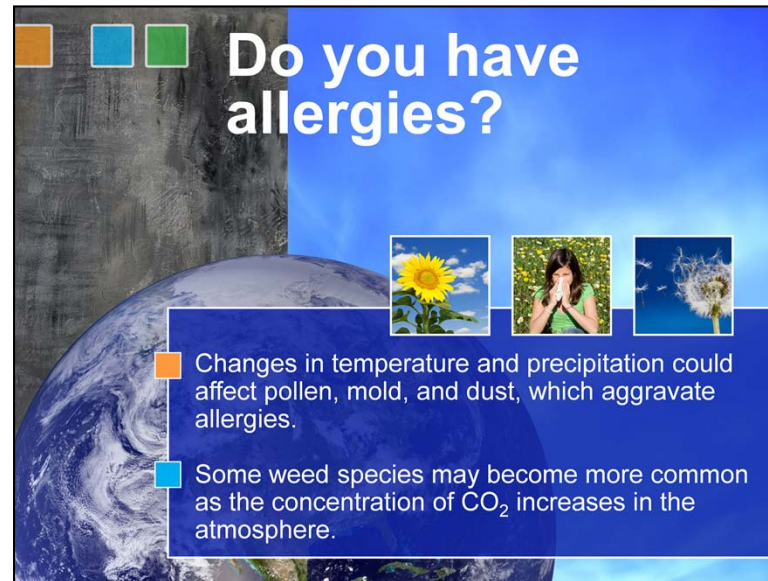




Do you have asthma?



- A warmer climate may decrease air quality.
- Higher temperatures increase the formation of ground-level ozone, the main ingredient in urban smog.
- Smog can make it harder to breathe, especially for people with asthma.



Do you have allergies?

- Changes in temperature and precipitation could affect pollen, mold, and dust, which aggravate allergies.
- Some weed species may become more common as the concentration of CO₂ increases in the atmosphere.

Carbon dioxide (CO₂) is a natural “fertilizer” for plants because they use carbon dioxide in photosynthesis. But not all plant species respond in the same ways to increasing concentrations of carbon dioxide in the atmosphere—some species grow faster when CO₂ is higher, while others see less benefit. Furthermore, the other impacts of climate change (such as changes in temperature and precipitation) may have negative impacts on many plant species; it’s difficult to predict what the net effect will be.

Do you live along the coast or somewhere where storms are frequent?



- Floods and droughts could become more common or severe in some areas.
- Higher sea levels could increase coastal flooding and storm damage.
- Flooding could increase the risk of disease from contaminated water and food supplies.

Children are more vulnerable to disasters than adults are because they typically rely on others to care for them. Young children may need specialized medical care after disasters due to their size and other factors.

Floodwater may carry bacteria. Even if drinking water supplies remain safe, you could get sick if you come into direct contact with floodwater.



Do you live near a forest or grassland?

- Wildfires pose direct risks to your safety and cause particle pollution (soot), which affects air quality.
- In California, the risk of large wildfires could increase by as much as 50 percent over the next 100 years.

Childhood exposure to particle pollution has been associated with respiratory symptoms, decreased lung function, exacerbation of asthma, and development of chronic bronchitis. Some communities with high particulate levels have been shown to have increased rates of pre-term births, lower birth weights, and higher infant mortality.

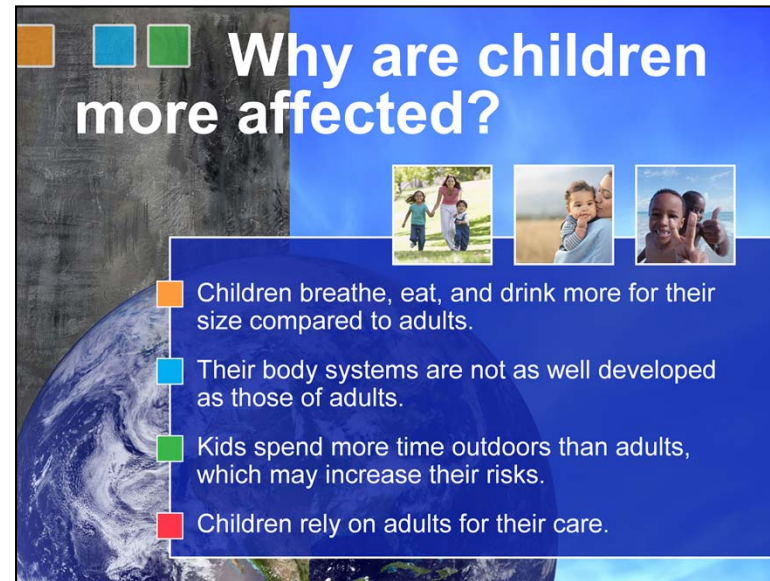
California fire risk figure comes from www.energy.ca.gov/2005publications/CEC-500-2005-190/CEC-500-2005-190-SF.PDF.

Do you spend a lot of time outside?

- Changes in climate could make conditions more favorable to mosquitoes, other insects, and animals that may carry diseases.
- Heat waves could increase the risk of heat dehydration, heat stroke, and other illnesses.

Mosquitoes can carry dangerous diseases such as West Nile virus, malaria, and dengue fever. In the United States, we are usually able to keep such diseases under control. That is not the case in poorer countries, such as many African and South American nations, however. The risks are much greater there.

Heat waves in cities tend to be more severe than in surrounding countryside because pavement and buildings tend to absorb heat, while trees and grass reflect it. Children, pregnant women, and older adults are especially vulnerable to heat-related illnesses.



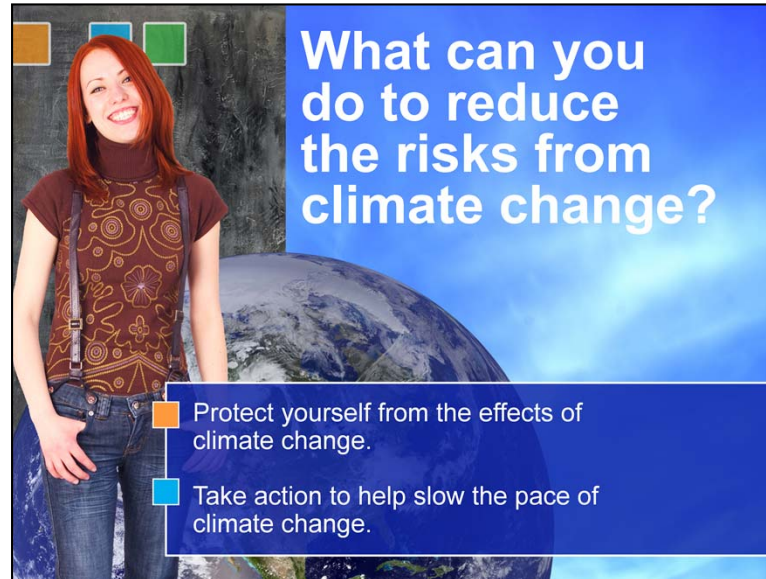
Why are children more affected?

- Children breathe, eat, and drink more for their size compared to adults.
- Their body systems are not as well developed as those of adults.
- Kids spend more time outdoors than adults, which may increase their risks.
- Children rely on adults for their care.

People in developing countries generally face greater risks than those in industrialized nations such as the United States because they lack systems, technologies, and access to health care that could protect them from many of the impacts of climate change.

Worldwide, 66.5 million kids were affected by weather-related disasters every year between 1990 and 2000.

References: 66.5 million children were affected by weather-related disasters every year between 1990 and 2000: [Penrose A, 2006](#).

A woman with red hair, wearing a brown patterned t-shirt and blue jeans, stands next to a large globe. The background is a blue sky with clouds. The text "What can you do to reduce the risks from climate change?" is displayed in white on a blue background. Below the text, there are two bullet points: "Protect yourself from the effects of climate change." and "Take action to help slow the pace of climate change." Each bullet point is preceded by a small colored square (orange and blue respectively).

What can you do to reduce the risks from climate change?

- Protect yourself from the effects of climate change.
- Take action to help slow the pace of climate change.



Protect Yourself From Poor Air Quality

- If you have asthma or allergies, ask your doctor for advice on how to avoid places and situations that can cause an asthma attack or an allergic reaction.
- Check the Air Quality Index (AQI). Limit outdoor activity on poor air quality days.

For more information about the Air Quality Index (AQI), visit <http://airnow.gov>.



Protect Yourself From Weather-Related Disasters

- Know what to do during a storm, flood, or forest fire. Rehearse emergency plans with your parents at home, just like you do at school with fire drills.
- Stay away from flooded areas after a storm because the water may be contaminated, and floodwater can cause mold to grow.

See EPA's Web page on flood risks to children for more information:
<http://yosemite.epa.gov/ochp/ochpweb.nsf/content/flood.htm>.

Avoid moldy areas, such as houses that have been flooded. The mold can provoke asthma attacks or allergic reactions.



Protect Yourself From Diseases



- Wash fruits and vegetables before you eat them to remove pesticides, bacteria, and other organisms.
- If there are mosquitoes or other biting insects where you live, wear long-sleeved clothing and use insect repellent. (Follow the instructions on the label when using insect repellent.)



Protect Yourself From Heat Waves

- During a heat wave, drink plenty of water and stay in the shade if possible.
- If it's really hot outside, find indoor activities in an air-conditioned place.
- Wear light, loose-fitting clothes on hot days.

For more information, visit EPA's Web page on heat waves and children:
<http://yosemite.epa.gov/ochp/ochpweb.nsf/content/heat.htm>.



Take Action to Slow the Pace of Climate Change

- We all contribute to climate change by using energy produced by fossil fuels, by generating waste, and by other activities that release greenhouse gases into the atmosphere.
- Since we're all part of the problem, we can all be part of the solution.

We burn fossil fuels for energy for modern day conveniences such as our lights, heating, and air conditioning.



What You Can Do

The solutions are simple:

- Use less gasoline, natural gas, propane, coal, and oil, and electricity produced by burning these fuels.
- Generate less waste. Reducing waste saves energy and avoids methane emissions from landfills.

A person wearing a pink baseball cap, sunglasses, a black hoodie, and blue jeans is sitting on the edge of the Earth, pointing upwards with their right index finger. The background is a bright blue sky with wispy clouds. The person is wearing white sneakers with pink accents.

What You Can Do

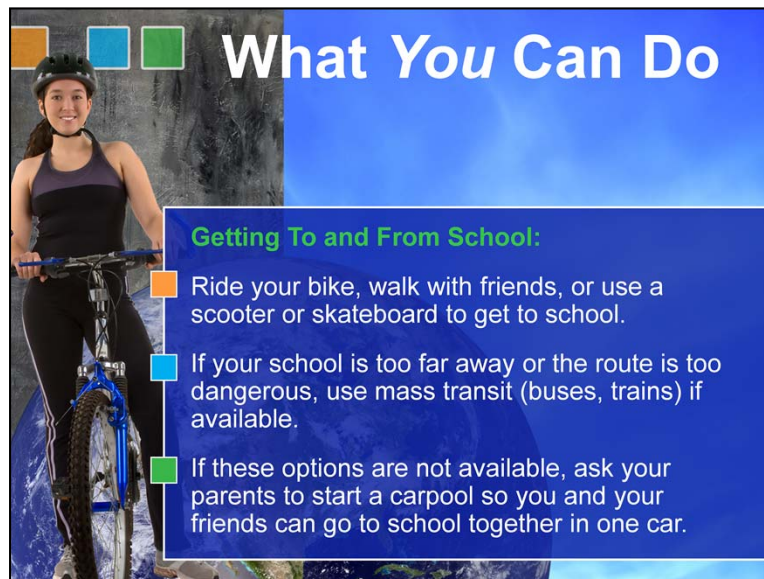
- Reduce your carbon footprint.

Most of us don't pay attention to our energy use or how much waste we generate. The next few slides will show you how to change that.

A man with dreadlocks and headphones is jumping over the Earth, holding a small object in his hand. The background is a blue sky with clouds. The image is divided into two main sections: a top section with a blue background and a bottom section with a dark blue background. The top section contains the title and a list of three colored squares (orange, blue, green). The bottom section contains two bullet points, each preceded by a colored square (orange and blue respectively).

But first, what is your carbon footprint?

- Your carbon footprint is a measure of the greenhouse gases that are produced by your activities that involve burning fossil fuels.
- Using less energy and reducing waste will help you reduce your carbon footprint.



What You Can Do

Getting To and From School:

- Ride your bike, walk with friends, or use a scooter or skateboard to get to school.
- If your school is too far away or the route is too dangerous, use mass transit (buses, trains) if available.
- If these options are not available, ask your parents to start a carpool so you and your friends can go to school together in one car.

Other resources for schools:

ENERGY STAR's "how to get started" page for K-12 schools:
www.energystar.gov/index.cfm?c=k12_schools.bus_schoolsk12.



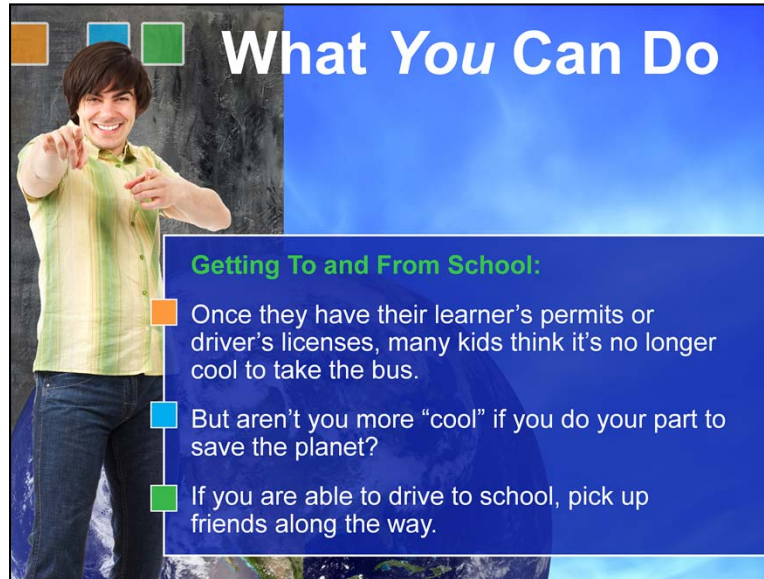
What You Can Do

Getting To and From School:

- Students at Montgomery Blair High School in Maryland convinced the local government to provide free bus rides after school, between 2 and 7 p.m.
- The “Kids Ride Free” program encourages kids to take public transportation and saves their parents money.

Information on the Kids Ride Free program is available at:

www.montgomerycountymd.gov/tsvtmpl.asp?url=/content/DOT/transit/kids_free_ride.asp.



What You Can Do

Getting To and From School:

- Once they have their learner's permits or driver's licenses, many kids think it's no longer cool to take the bus.
- But aren't you more "cool" if you do your part to save the planet?
- If you are able to drive to school, pick up friends along the way.



What You Can Do

Reducing Waste at School:

- Recycle your paper, bottles, and cans.
- Ask your school to consider using recycled paper and other products.
- Ask your school to consider composting food and kitchen waste.

You can do all these things at home too!



What You Can Do

Greening Your School:

- Encourage your school to take the ENERGY STAR® Challenge (www.energystar.gov/challenge) to reduce energy use and save money.
- Planting a garden on your school's roof keeps the building cooler, reduces energy use, avoids greenhouse gas emissions, and saves money.

More information on green roofs is available on EPA's Urban Heat Island site: www.epa.gov/heatisland.



What You Can Do

Greening Your School:

- Another way to reduce fossil fuel use is to switch to renewable energy sources. Encourage your school to purchase green power generated from the sun, wind, water, and plant materials.
- Kids at many U.S. schools have developed renewable energy projects, such as solar cars. You can too!



The free Climate CHECK tool runs on Microsoft Excel. It provides educational information on climate change and prepares a complete greenhouse gas inventory for your school. The tool meets National Science Content Standards and is aimed primarily at high school students.



What You Can Do

Greening Your Home: *Energy Use*

- Ask your family to replace your light bulbs with ones with the ENERGY STAR® label for energy efficiency.
- Turn off the lights when you leave a room.
- Turn the heat down in winter (and set the A/C temperature higher in summer) to save energy and emissions.

You will reduce your family's energy use by taking these important steps.



What You Can Do

Greening Your Home: *Electronics*

- Make sure your computer's energy-saving sleep feature is turned on.
- Turn off TVs and other electronics when not in use.
- Unplug MP3 players and cell phone chargers when not in use.
- Recycle old cell phones and other electronic equipment.

Consider buying used electronics to save money and the environment.



Heating water uses energy and results in greenhouse gas emissions. A shower aerator gives you a stronger shower but uses less hot water. Shower and faucet aerators are cheap and make good Earth-friendly gifts for your parents.

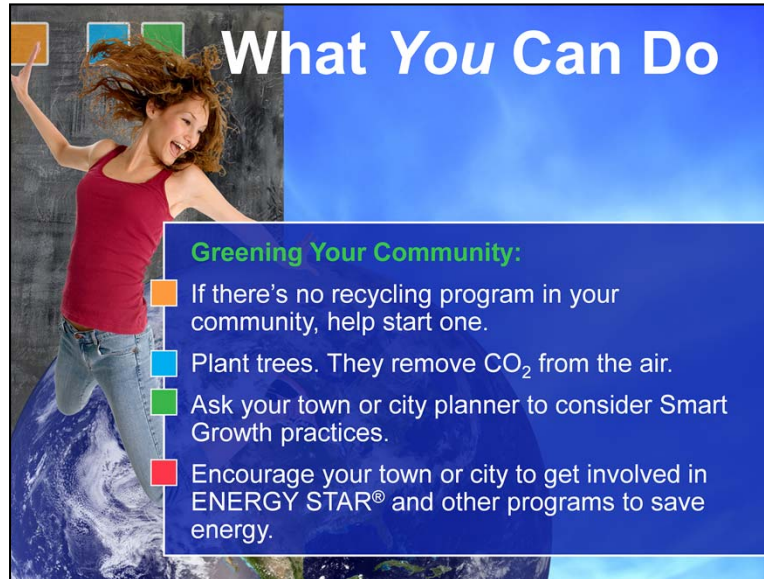
A person is standing on a globe, with their legs and feet visible. The background is a bright blue sky. The person is wearing dark pants and white sneakers. The globe shows the Earth's surface with clouds and landmasses.

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What You Can Do

Greening Your Home: *Waste*

- Recycle magazines, food and beverage containers, and paper.
- Sell or donate old clothing and other items you no longer use.
- Shop for products that use less packaging so there's less waste.
- Bring your own shopping bags with you.



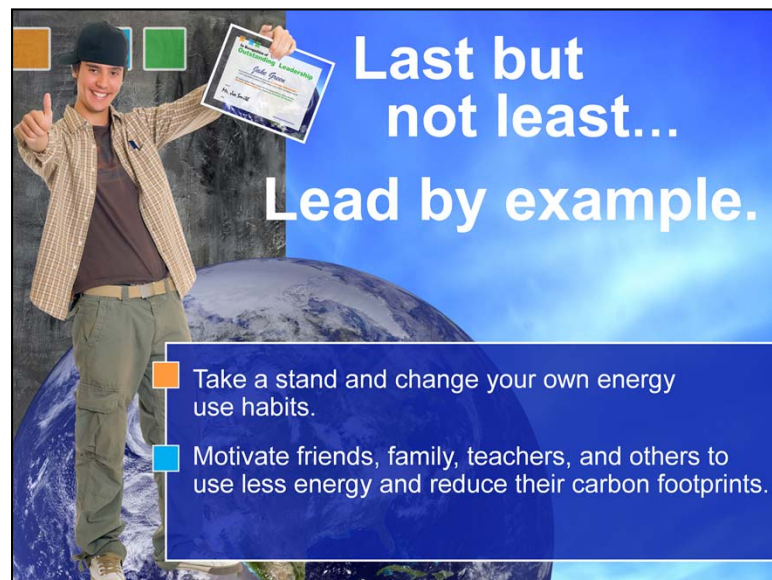
What You Can Do

Greening Your Community:

- If there's no recycling program in your community, help start one.
- Plant trees. They remove CO₂ from the air.
- Ask your town or city planner to consider Smart Growth practices.
- Encourage your town or city to get involved in ENERGY STAR® and other programs to save energy.

Smart Growth allows towns and cities to develop in ways that preserve natural lands and critical environmental areas, protect water and air quality, and reuse already developed land. For more information on Smart Growth, see www.epa.gov/smartgrowth.

For more information about ENERGY STAR, see www.energystar.gov.



- Motivate other students to give climate change and children's health presentations to other students, youth organizations, at school, or in the community.
- Encourage people to [Change the World and Take the ENERGY STAR Pledge](https://www.energystar.gov/index.cfm?fuseaction=globalwarming.showpledge) (<https://www.energystar.gov/index.cfm?fuseaction=globalwarming.showpledge>). The pledge encourages changes throughout the home. If every American home replaced just one light bulb with an ENERGY STAR qualified bulb, we would prevent the same amount of greenhouse gases as that emitted each year by **more than 800,000 cars**.
- Lead an effort to reduce energy consumption in your school or community and calculate your results. Examples include getting more students to walk, bike, carpool, or take a bus to school or reducing the amount of waste produced at your school or in your community.





More detailed information on climate change risks to children's health is available at:

<http://yosemite.epa.gov/ochp/ochpweb.nsf/content/climate.htm>.